

NOTES ON REPRODUCTION IN *ASPIDIOTUS*
hederæ (COCCIDÆ).

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Our present knowledge of the reproductive processes in the Diaspinæ is a very limited one. The following observations represent a rather cursory attack on this aspect of the biology of the oleander scale (*Aspidiotus hederæ*) and in view of the lack of similar studies on this group of Coccidæ no attempt is made to arrive at any final and concluding generalizations.

The study had its inception in the very interesting paper of E. Gabritschewsky ('25) and so far as its more particular purpose is concerned, hinges especially on Gabritschewsky's statement regarding *Aspidiotus hederæ* that "bisexual cultures live on the plant *Aucuba japonica*; parthenogenetic or unisexually-female cultures grow best on a variety of palms." It will be seen that Gabritschewsky does not commit himself on a possible relationship between host plant and mode of reproduction and it is only fair to state that he was not primarily concerned with that aspect. Nevertheless, the possibility that there might be some correlation between the type of host plant and the presence or absence of males induced me to investigate the species with this point in view.

Parthenogenesis has been reported for various Diaspinæ on several occasions. However so far as I know, no controlled experiments have been made to sustain these contentions and certainly the observed scarcity or absence of males in several instances is insufficient to establish the point.

In the present case, the work took the following form: The stock cultures were derived from oleander plants. Larvae that had just escaped from the egg were isolated on plants which had been cleaned with great care, and the plants were then covered with lamp chimneys whose tops were covered with fine meshed gauze.

Many of the insects were injured in the transfer and died within a short time. Some others apparently attached themselves successfully but died during more or less advanced instars. Out of 34 larvae that attached themselves after isolation only 9 reached the reproductive stage, the deaths being distributed approximately evenly over the various instars. The host plants used were *Aucuba japonica*, *Hedera helix*, and an unidentified palm. The offspring of the isolated insects were not counted until they themselves had reached the adult stage. This was done because of the great difficulty of counting the migrating larvae that have just hatched and means of course that the number of individuals in each brood as here given is not as great as the number of eggs or first instars produced by each isolated insect.

	Date of Isolation	Host	Young first appeared	Number reaching adult stage.	Sex
1.	Oct. 7	Hedera	Feb. 1	12	Female
2.	Oct. 7	Hedera	Feb. 3	28	Female
3.	Oct. 22	Hedera	Feb. 10	10	Female
4.	Oct. 7	Aucuba	Jan. 2	50	Female
5.	Oct. 7	Aucuba	Jan. 4	10	Female
6.	Oct. 7	Aucuba	Jan. 8	24	Female
7.	Oct. 22	Aucuba	Jan. 28	45	Female
8. ¹	Jan. 10	Aucuba	April 1	52	Female
9.	Oct.	Palm	Jan. 15	9	Female

The breeding experiments demonstrate the following points: *a.* The nine isolated individuals as well as all of their offspring were females. No males arose on either palm or *Hedera* plants. *b.* Reproduction occurs without mating, regardless of the type of host plant. *c.* The life cycle is com-

¹This individual was obtained from Experiment No. 4 and thus represents a second generation raised under control.

The temperature of the greenhouse used was very variable, ranging from 55° to 90° F.

pleted more quickly on *Aucuba* than on *Hedera* and palm.

In any other group of insects, this evidence might be deemed sufficient to demonstrate that parthenogenesis occurs in the species. But it must not be forgotten that it is in the Coccidae that a case of functional hermaphroditism is encountered (*Icerya purchasi*, one of the Monophlebinæ as reported by Hughes-Schrader, '25).

In such an instance no breeding experiments of the type I have described will in themselves settle the question. Only a cytological examination would finally decide the point and such an examination was made in *Aspidiotus*. This shows that not only is there no internal evidence of the presence of any male tissue in the females, but also that the maturation and development of the eggs follow a series of steps which is typical of so-called diploid parthenogenesis.

The somatic cells of immature as well as mature females carry 8 chromosomes. In the course of maturation of the egg, 8 chromosome threads are formed and these show no trace of bivalence or tetrad structure (Fig. 1.). 8 chromosomes also appear in the stages of final condensation (Fig. 2.) so that evidently there is no pairing of the chromosomes. Only a single meiotic division takes place and this is equational in nature, 8 chromosomes going to each pole. Apparently the polar body is not actually extruded but remains at the periphery while the egg nucleus migrates toward the center of the egg (Fig. 3.). Further divisions of this egg nucleus occur in a quite normal manner and the cleavage nuclei all carry 8 chromosomes. (Fig. 4.).

It is plain that taken together, the experimental and cytological evidence demonstrate that in this particular stock of *Aspidiotus hederae* reproduction is parthenogenetic and normally results in nothing but females. But it would be rash to generalize on this basis. Males have certainly been described for the species and as mentioned above Gabritschewsky reports that males were produced on some of the plants under his observation. Indeed it may well be that some stocks of the species are more susceptible to environmental influence than others and that in such cases the host plant may drastically affect the process of re-

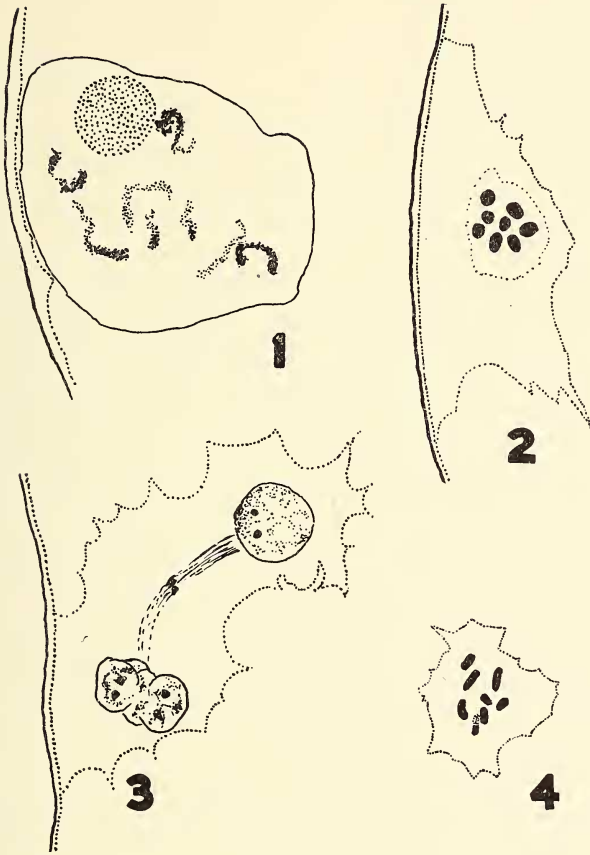


Fig. 1. Prophase stage showing 8 chromosome threads.

Fig. 2. Metaphase of maturation division.

Fig. 3. Telophase of maturation division, with polar body near periphery of the egg.

Fig. 4. Cleavage nucleus showing 8 chromosomes.

Drawn with 15X ocular and 2mm. oil immersion, using camera lucida.

production. Gabritschevsky's observations were made in Russia so that geographically at least the two stocks of insects used are widely separated. However for the present, I am inclined to adopt the explanation that is presented in the investigations of Thomsen ('27) on *Lecanium hemisphæricum* and *Lecanium hesperidum*. In both of these species there are two distinct races. In one race reproduction is always parthenogenetic and no males are found. The other race however is facultatively parthenogenetic and its eggs are capable of fertilization or, lacking that, of parthenogenetic development. The cytology of the two races is radically different. I suggest that in *Aspidiotus hederæ* also, there may be two races of this kind. The race that I have worked on reproduces solely through parthenogenesis and indeed, its cytology is in principle identical with the corresponding race of *Lecanium*. That the other race exists also is supported by the recorded occurrence of males as well as by Gabritschevsky's findings, who may well have had a mixed population composed of both the races in question.

References.

Gabritschevsky, E.

1925. Postembryonale Entwicklung, Parthenogenese und Pedogamie bei den Schildläusen (Coccidæ). Russian, with German summary. *Revue Zoologique russe*, Vol. 3.

Hughes-Schrader, Sally.

1925. Cytology of hermaphroditism in *Icerya purchasi* (Coccidæ). *Zeitschr. Zellforsch. mikr. Anat.*, Vol. 2.

Thomsen, M.

1927. Studien über die Parthenogenese bei einigen Cocciden und Aleurodiden. *Zeitschr. Zellforsch. mikr. Anat.*, Vol. 5.